



US009448030B2

(12) **United States Patent**
Hines

(10) **Patent No.:** **US 9,448,030 B2**
(45) **Date of Patent:** ***Sep. 20, 2016**

(54) **GRIP/COVER FOR KEY LOCK SYSTEM**

(71) Applicant: **Stephen Charles Hines**, Edgewood,
NM (US)

(72) Inventor: **Stephen Charles Hines**, Edgewood,
NM (US)

(73) Assignee: **Falcon Industries, Inc.**, Edgewood,
NM (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

This patent is subject to a terminal dis-
claimer.

(21) Appl. No.: **15/015,773**

(22) Filed: **Feb. 4, 2016**

(65) **Prior Publication Data**

US 2016/0169610 A1 Jun. 16, 2016

Related U.S. Application Data

(63) Continuation-in-part of application No. 14/865,692,
filed on Sep. 25, 2015, which is a continuation-in-part
of application No. 14/593,134, filed on Jan. 9, 2015,
now Pat. No. 9,234,721, which is a continuation of
application No. 29/478,902, filed on Jan. 9, 2014,
now Pat. No. Des. 734,418, application No.
15/015,773, which is a continuation-in-part of
application No. 13/800,887, filed on Mar. 13, 2013,
now Pat. No. 9,279,639.

(60) Provisional application No. 61/925,451, filed on Jan.
9, 2014, provisional application No. 61/778,407, filed
on Mar. 12, 2013, provisional application No.
61/610,281, filed on Mar. 13, 2012, provisional
application No. 62/232,393, filed on Sep. 24, 2015,
provisional application No. 62/056,172, filed on Sep.
26, 2014.

(51) **Int. Cl.**

F41A 17/20 (2006.01)

F41A 35/00 (2006.01)

(52) **U.S. Cl.**

CPC **F41A 35/00** (2013.01)

(58) **Field of Classification Search**

CPC F41C 23/16; F41C 23/10; F41A 17/066;
F41A 17/20; F41A 17/02

USPC 42/71.02, 71.01, 72, 90, 70.11, 111

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,128,571 A 4/1964 Herrett
5,392,550 A 2/1995 Moore et al.
5,522,166 A * 6/1996 Martel F41G 11/003
42/124

6,487,804 B1 12/2002 Petrella, Jr.
7,627,975 B1 12/2009 Hines

(Continued)

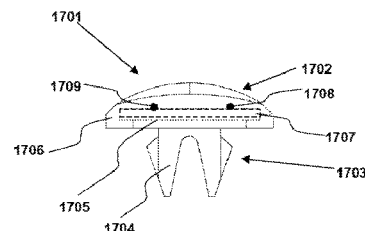
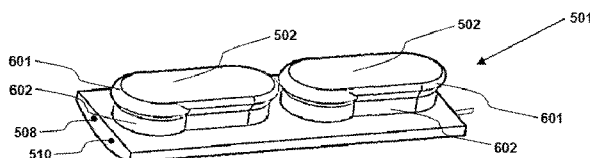
Primary Examiner — Michael David

(74) *Attorney, Agent, or Firm* — Richard H. Krukar; Luis
M. Ortiz; Kermit D. Lopez

(57) **ABSTRACT**

Covers for key lock mounting systems on small arms such
as the AR or M4 family of rifles and carbines can provide
protection for the firearm, comfort for the operator, and
electrical power to firearm accessories. The cover has key-
hole grips that are pressed into the key lock mounting points
in mounting system. The cover is held seated against the
surface of the mounting system by the shape and resilience
of keyhole grips. V-notch keyhole grips can attach to key-
hole shaped mounting points and slot shaped mounting
points. The covers have connectors and internal circuitry
such that covers lined up edge to edge are electrically
connected. Firearm accessories can be electrically powered
the connectors.

18 Claims, 11 Drawing Sheets



(56)

References Cited

U.S. PATENT DOCUMENTS

8,091,265 B1 1/2012 Teetzel et al.
 9,222,749 B1* 12/2015 Nakayama F41C 23/16
 2003/0106252 A1* 6/2003 Hines F41A 35/02
 42/90
 2008/0289237 A1 11/2008 Pikielny
 2009/0241397 A1* 10/2009 Fitzpatrick F41C 23/16
 42/90
 2010/0175293 A1 7/2010 Hines
 2010/0192446 A1 8/2010 Darian
 2010/0192448 A1 8/2010 Darian
 2010/0214470 A1 8/2010 Cottagnoud
 2010/0275489 A1 11/2010 Cabahug et al.
 2011/0000120 A1 1/2011 Thompson
 2011/0167698 A1 7/2011 Hogue
 2011/0192066 A1 8/2011 Kimmel et al.
 2011/0232149 A1* 9/2011 Fagnoli F41A 3/54
 42/16
 2012/0085013 A1* 4/2012 Cahill F41A 35/02
 42/96
 2012/0311906 A1* 12/2012 Troy F41C 23/16
 42/71.01
 2013/0019510 A1 1/2013 Kemmerer et al.
 2013/0019512 A1 1/2013 Kemmerer et al.
 2013/0074394 A1* 3/2013 Larue F41G 1/28
 42/111
 2013/0125441 A1 5/2013 Westwood et al.

2014/0013642 A1* 1/2014 Larson, Jr. F41C 23/16
 42/71.01
 2014/0298703 A1* 10/2014 Gale F41C 27/00
 42/71.02
 2014/0325889 A1* 11/2014 Michal F41G 11/003
 42/75.01
 2015/0096215 A1* 4/2015 Somogy F41C 23/16
 42/71.01
 2015/0128470 A1* 5/2015 Troy, Jr. F41C 23/16
 42/90
 2015/0192386 A1* 7/2015 Hines F41C 23/16
 42/71.02
 2015/0198408 A1* 7/2015 Kincel F41C 23/16
 42/72
 2015/0219422 A1* 8/2015 Kincel F41C 23/16
 29/525.11
 2015/0241169 A1* 8/2015 Cheng F41G 1/00
 42/114
 2015/0285583 A1* 10/2015 Mayberry F41G 11/005
 42/71.01
 2015/0285584 A1* 10/2015 Mayberry F41C 23/16
 42/71.01
 2016/0084610 A1* 3/2016 Wood F41B 11/70
 124/80
 2016/0091272 A1* 3/2016 Hines F41C 23/16
 42/90
 2016/0116252 A1* 4/2016 Kincel F41C 27/00
 42/90

* cited by examiner

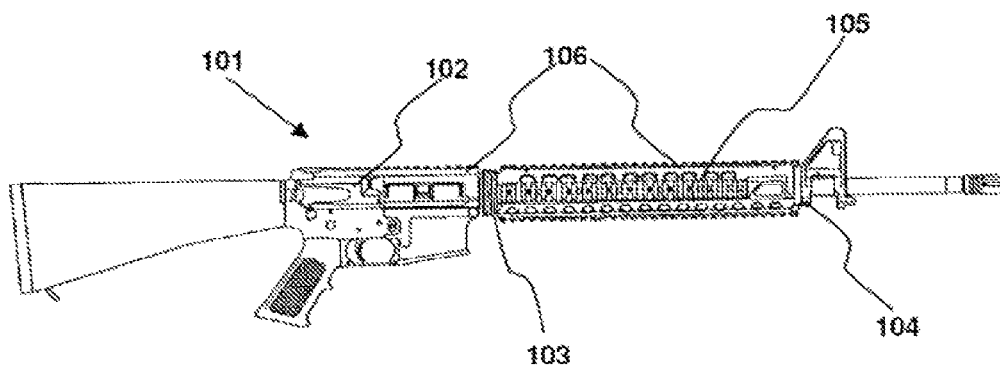


Fig. 1 (Prior Art)

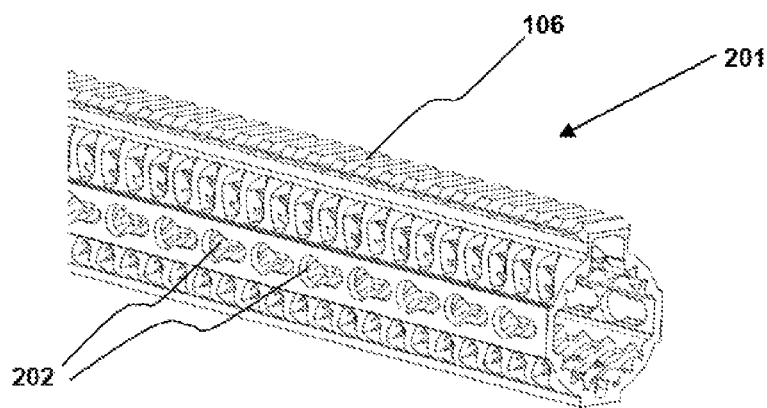


Fig. 2 (Prior Art)

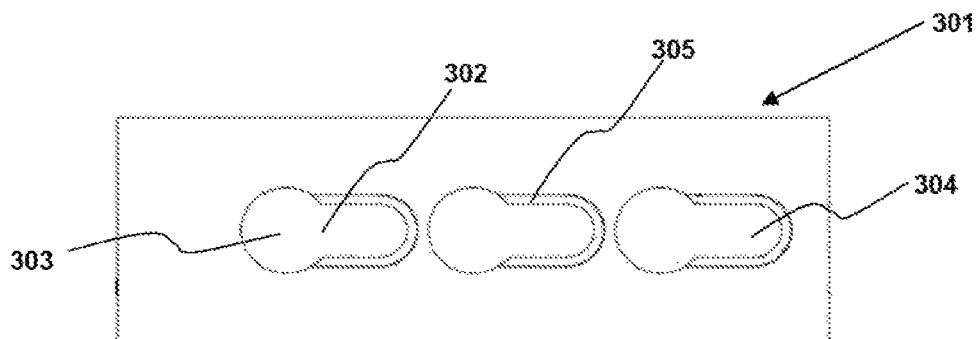


Fig. 3 (Prior Art)

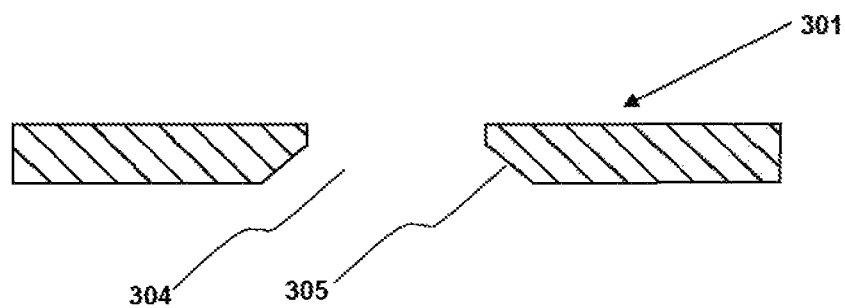


Fig. 4 (Prior Art)

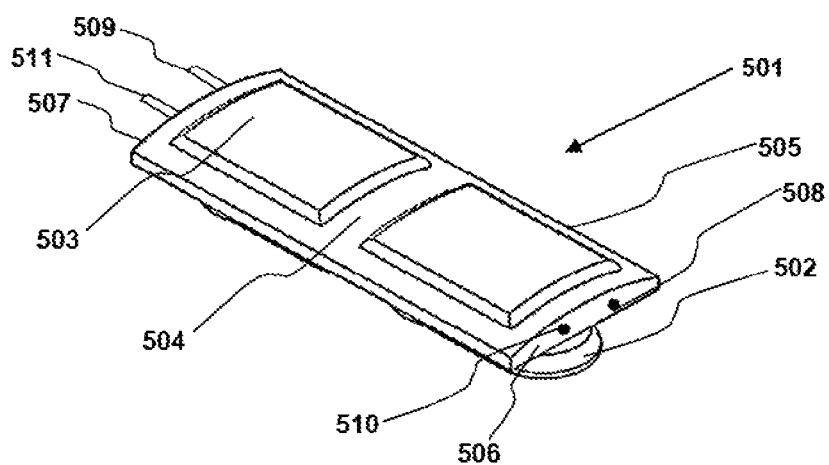


Fig. 5

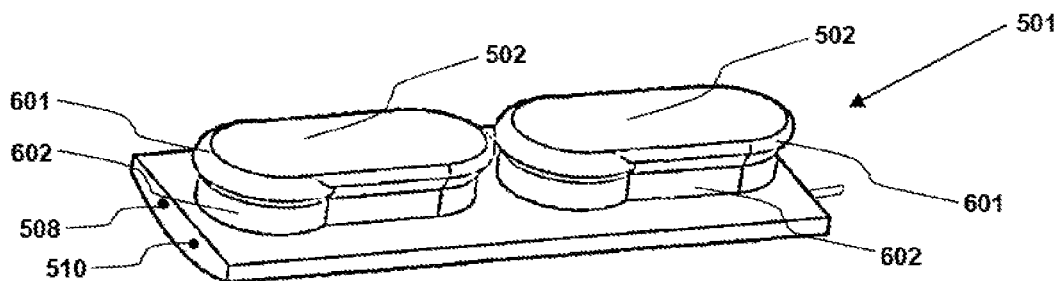


Fig. 6

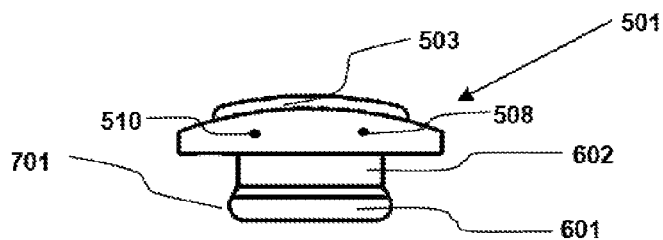


Fig. 7

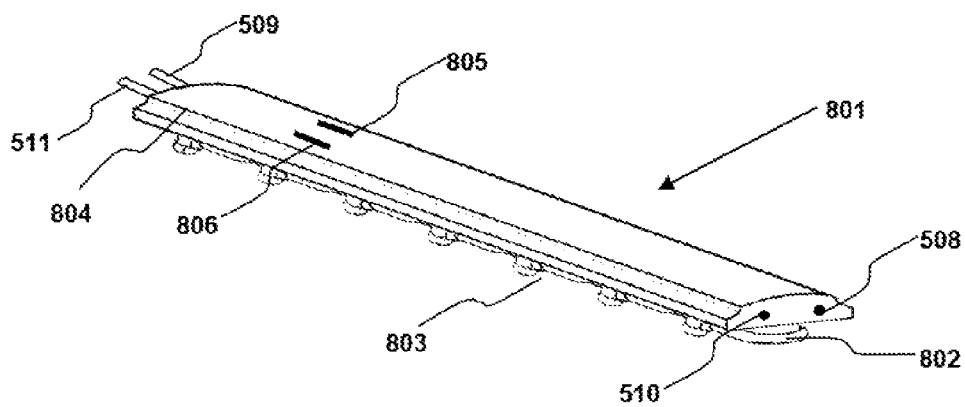


Fig. 8

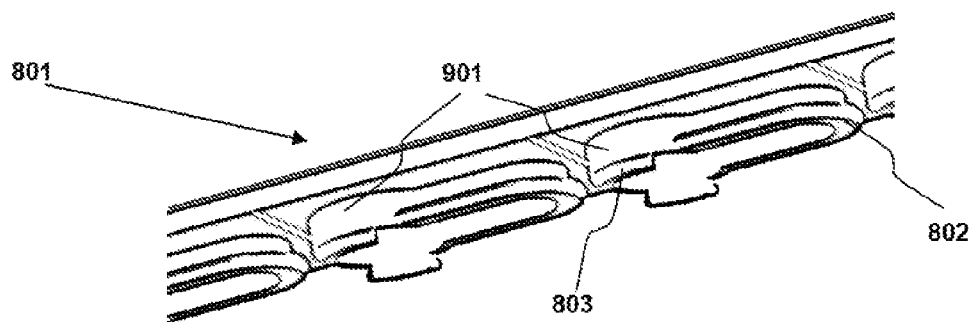


Fig. 9

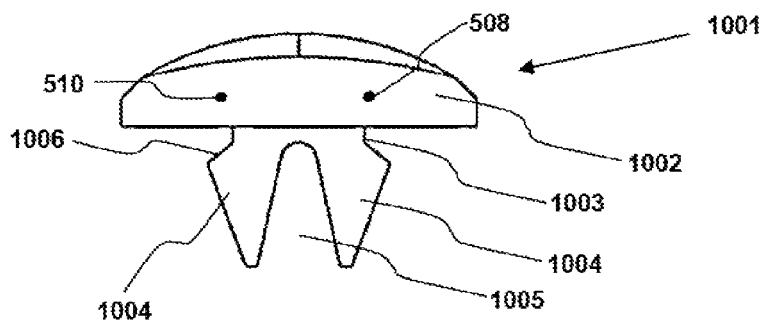


Fig. 10

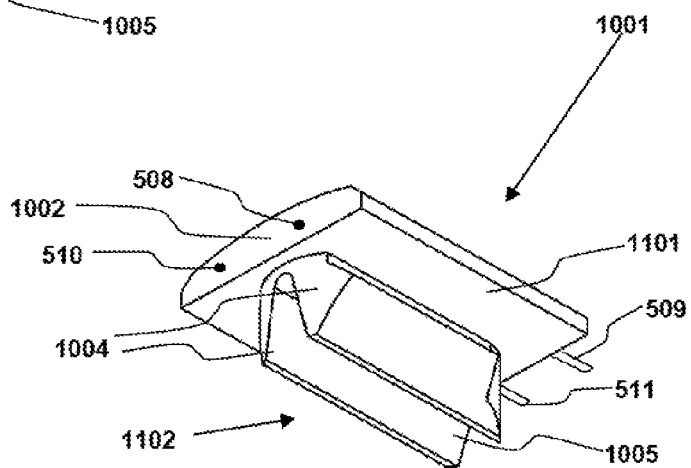


Fig. 11

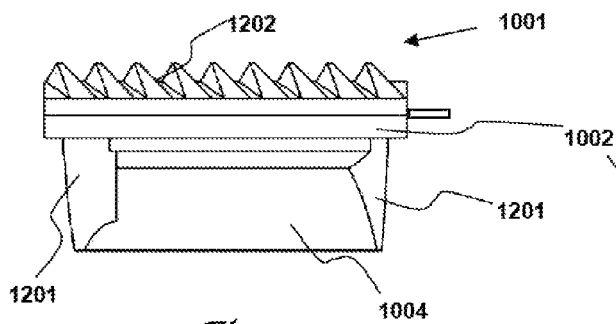


Fig. 12

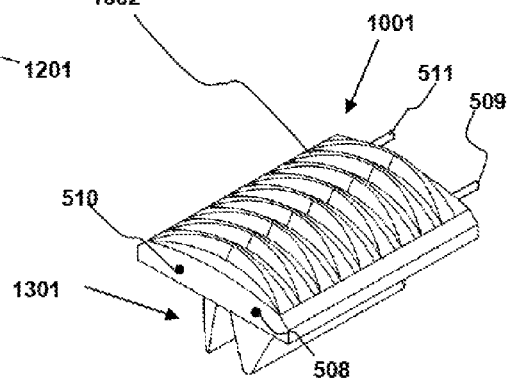


Fig. 13

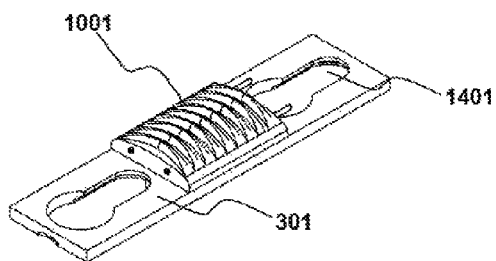


Fig. 14

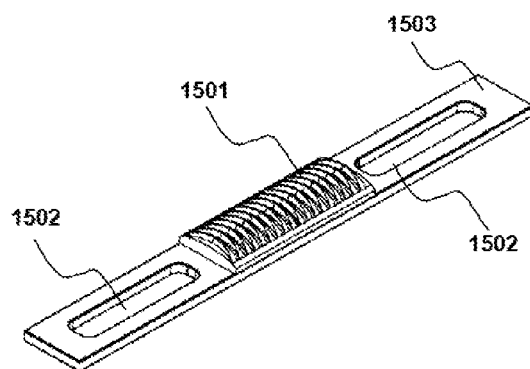


Fig. 15

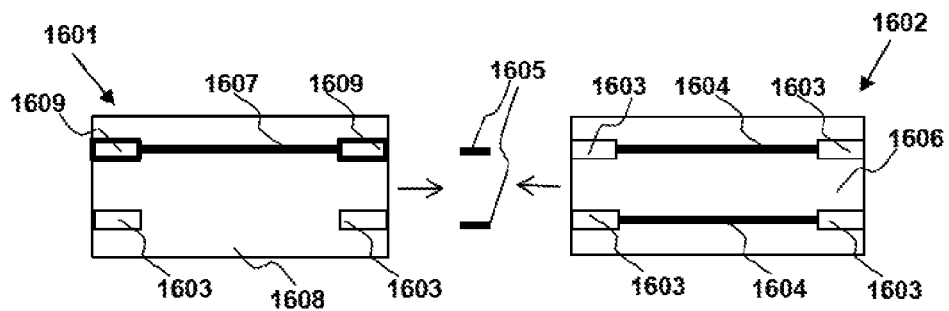


Fig. 16

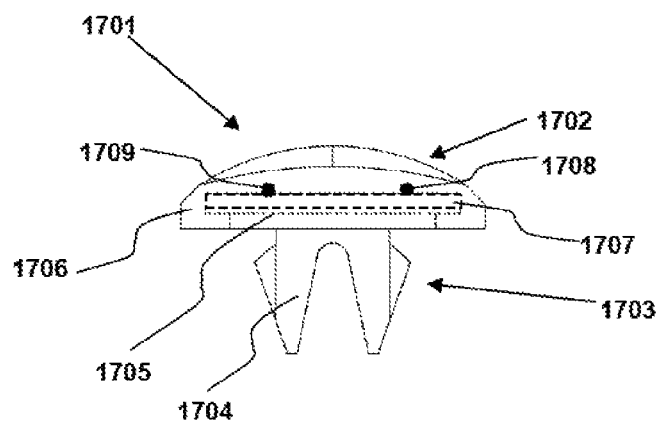


Fig. 17

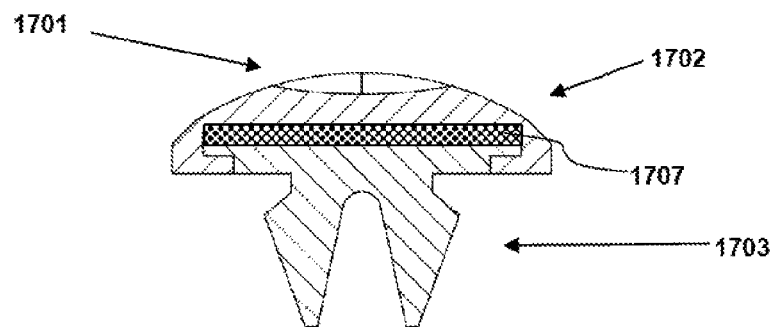


Fig. 18

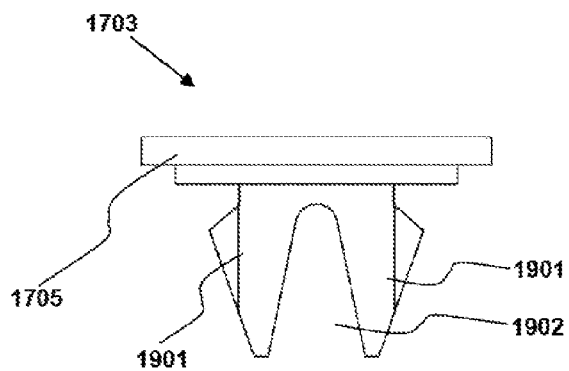


Fig. 19

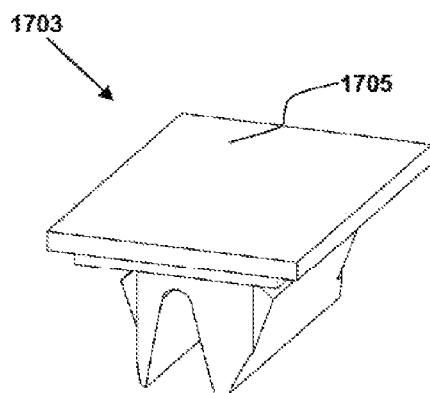


Fig. 20

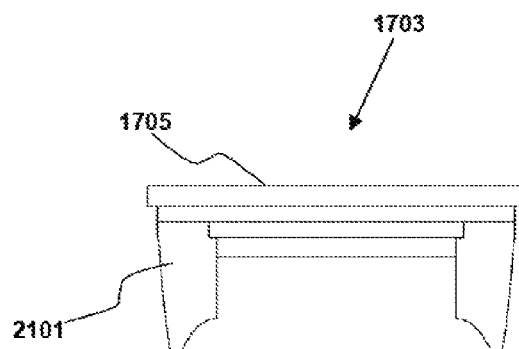


Fig. 21

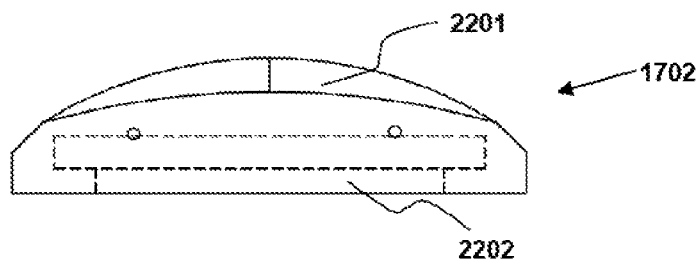


Fig. 22

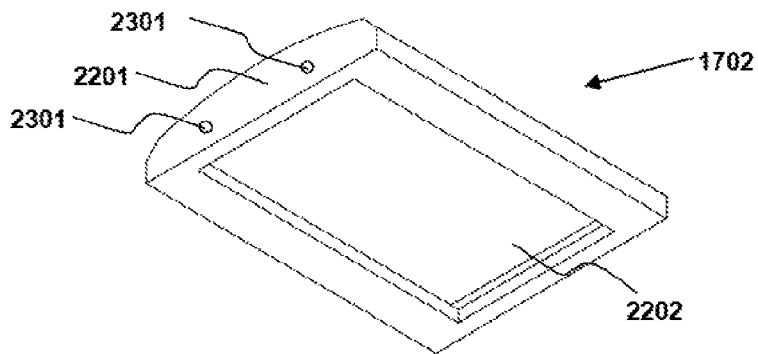


Fig. 23

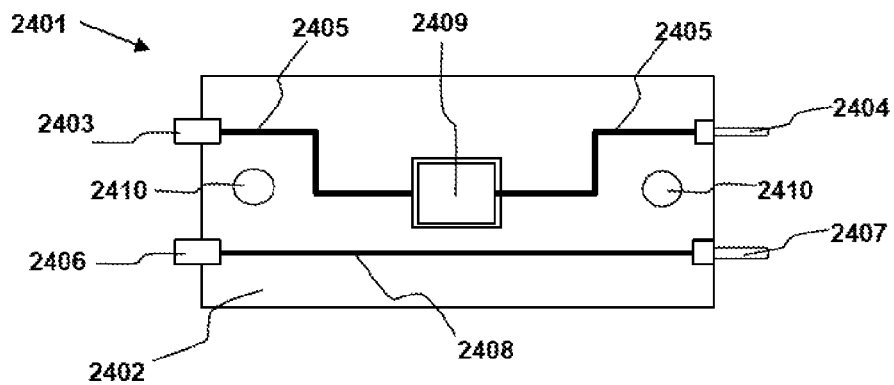


Fig. 24

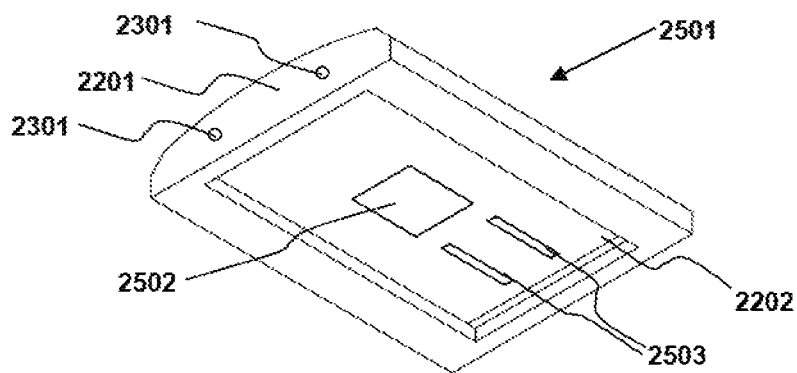


Fig. 25

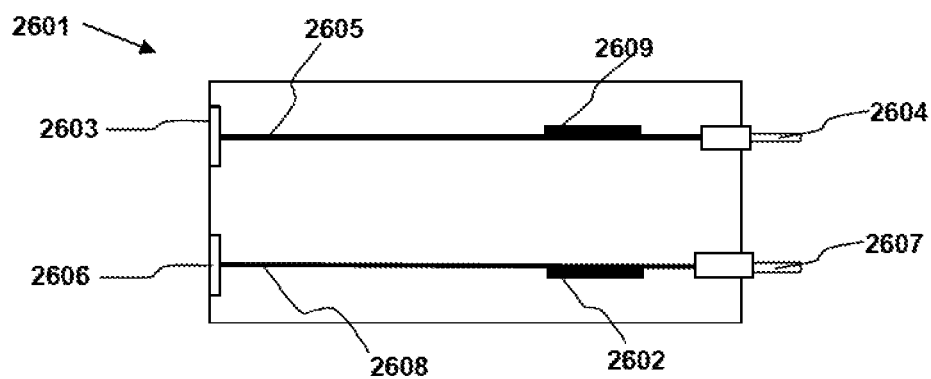


Fig. 26

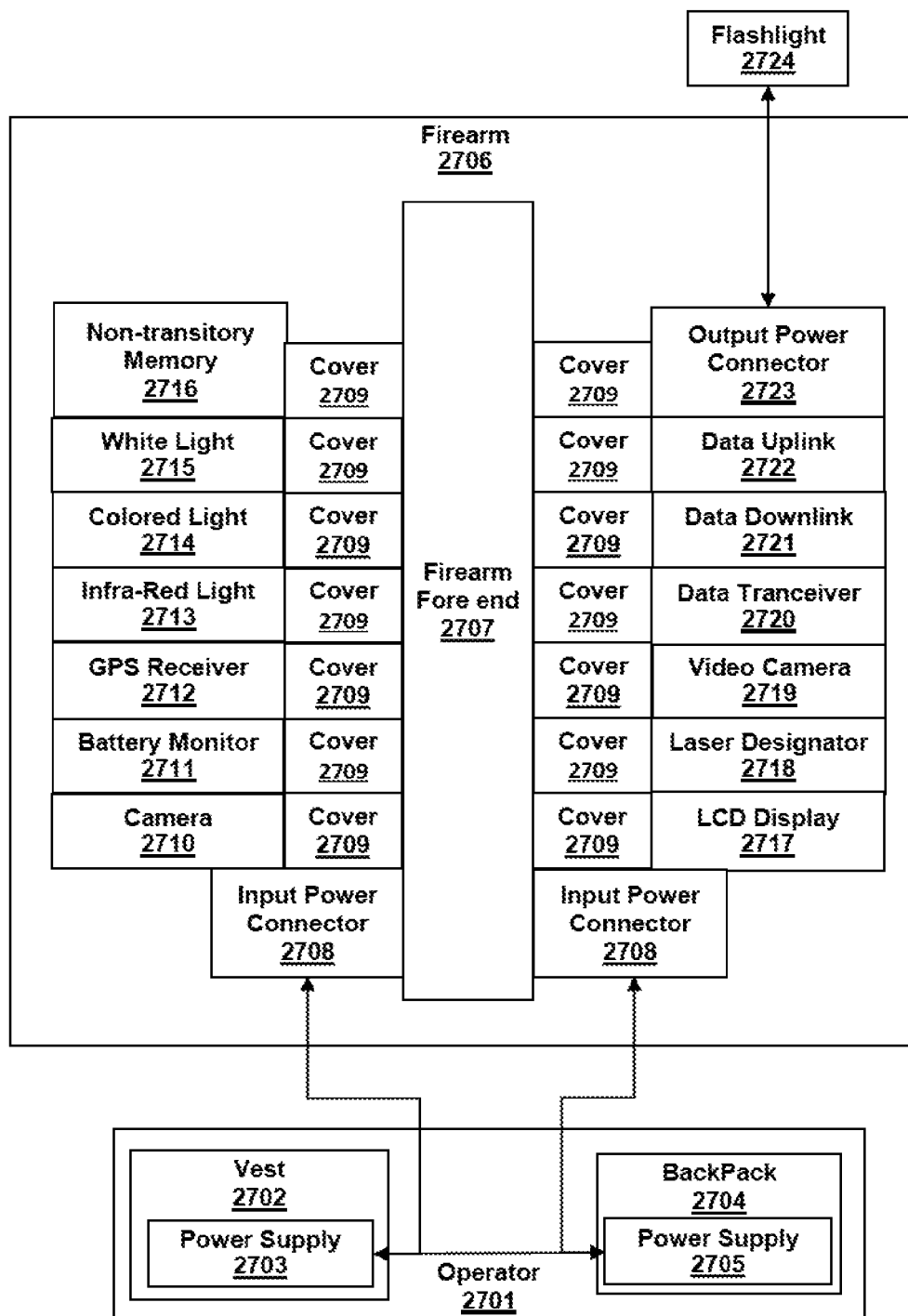


Fig. 27

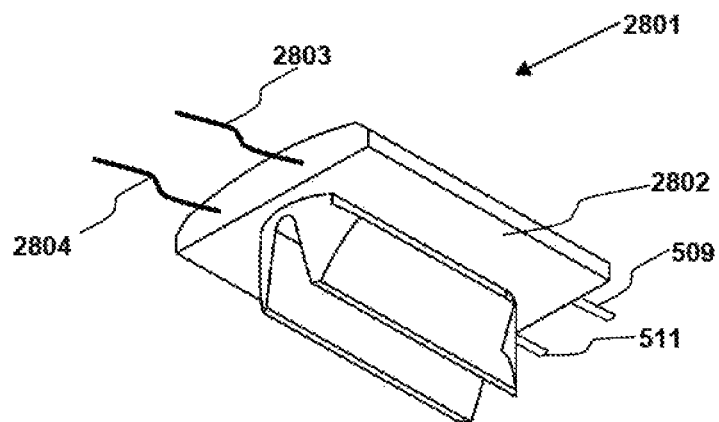


Fig. 28

GRIP/COVER FOR KEY LOCK SYSTEM

RELATED APPLICATIONS

This application is a continuation-in-part of U.S. patent application Ser. Nos. 14/865,692 and 13/800,887, claims the benefit and priority of U.S. patent application Ser. Nos. 14/593,134 and 29/478,902, and claims the priority and benefit of U.S. Provisional Applications 62/056,172, 62/232,393, 61/925,451, 61/610,281, and 61/778,407. U.S. patent application Ser. No. 14/865,692 was filed Sep. 25, 2015 and titled "Grip/Cover for Key Lock System" is a continuation-in-part of U.S. Ser. No. 14/593,134 and claims the benefit and priority of U.S. Provisional Applications 62/056,172 and 62/232,393. U.S. patent application Ser. No. 14/593,134 was filed Jan. 9, 2015, issued as U.S. Pat. No. 9,234,721 on Jan. 12, 2016, is titled "Cone Grip For Handgun," is a continuation of U.S. patent application Ser. No. 29/478,902 and claims priority and benefit of U.S. Provisional Application 61/925,451. U.S. patent application Ser. No. 13/800,887 filed Mar. 13, 2013 and titled "Powered Forward Module" claims the benefit and priority of U.S. Provisional Patent Applications 61/610,281 and 61/778,407. U.S. patent application Ser. No. 29/478,902 titled "Firearm Grip" was filed Jan. 9, 2014 and issued as Design Patent D734,418 on Jul. 14, 2015. U.S. Provisional Application 62/056,172 is titled "Cover for Key Lock Systems" and was filed Sep. 26, 2014. U.S. Provisional Application 62/232,393 is titled "Grip/Cover For Key Lock Systems" and was filed Sep. 24, 2015. U.S. Provisional Patent Application 61/925,451 is titled "Cone Grip for Handgun" and was filed on Jan. 9, 2014. U.S. Provisional Patent Application 61/610,281 is titled "Powered Forward Module" and was filed on Mar. 13, 2012. U.S. Provisional Patent Application 61/778,407 is titled "Powered Forward Module" and was filed on Mar. 12, 2013. U.S. patent application Ser. Nos. 14/865,692, 14/593,134, 13/800,887, and 29/478,902, are herein incorporated by reference in their entireties. U.S. Provisional Applications 62/056,172, 62/232,393, 61/925,451, 61/610,281, and 61/778,407 are herein incorporated by reference in their entireties.

TECHNICAL FIELD

Embodiments relate to the fields of small arms, firearms, firearm accessories, and firearm accessory mounting systems.

BACKGROUND

One of the most common firearm platforms currently in use forms the basis for the military M-16, M-4, civilian AR-15, and a plethora of related firearms. One of the most convenient aspects of the AR platform family is that the parts and pieces can be mixed and matched to produce a wide variety of firearms having different capabilities, different appearances, and even different calibers. The terms M-16, M-4, and AR are used interchangeably here because they refer to substantially similar firearms.

Current small arms use mounting rail systems for attaching accessories to the small arm. For example, M-4 and M-16 carbines are often fitted with a single piece handguard that incorporates up to four Picatinny rails. Picatinny rails are well known mounting rails that meet the specifications contained in MIL-STD-1913 and MIL-STD-1913 Notice 1. Another mounting rail called the Weaver rail is a notoriously well-known variation of the Picatinny rail. Battaglia dis-

closes a mounting rail system in U.S. Pat. No. 6,792,711 while Olson discloses another in U.S. Pat. No. 5,826,363.

Picatinny rails were attached to or formed into the upper receivers of M-16 style firearms to which sights such as scopes, red dots, and even iron sights have been mounted. Over time, more and more mounting rails have been added to the firearm with current models having mounting rails on the receiver and four mounting rails on the forward hand guard. The reason is that a vast number of rail mountable firearm accessories have become available. Examples of these firearms accessories include the aforementioned sights as well as lasers, flashlights, bayonets, grenade launchers, sling swivels, cameras, bipods, vertical fore grips, and other items. The mounting rails and associated mounting hardware were also became heavy as more and more rails and accessories were attached. To address this issue, M-lok and keylock mounting systems were developed as lighter and more ergonomic alternatives.

FIG. 1, labeled as "prior art," illustrates an M-16 type firearm **101** with mounting rails **106**. The specific rifle is a flat top model having a mounting rail **106** on the upper receiver **102** as well as the four on the handguard **105**. As is standard for M16 type firearms, the handguard **105** is attached to the firearm by being pushed into a front handguard cup **104** by a delta ring **103**. The illustrated handguard **101** has four non-powered mounting rails **106** of which three are visible. A number of accessories have been developed to attach to small arms by way of mounting rails **106**. The mounting rails have recoil grooves that help lock accessories in place and help users attach accessories in repeatable positions. Note that the term "firearm" used here and throughout this document is intended to include firearm replicas. In general, firearm replicas are toys or models that look substantially like fully functioning firearms and are designed to accommodate the same firearm accessories as those used with fully functional firearms. As such, FIG. 1 can also be a picture of a firearm replica. Certain AR style firearms have "free floating" handguards that do not have a front handguard cup **104** or delta ring **103** but instead are clamped or bolted onto the firearm where the barrel is attached to the upper receiver.

FIG. 2, labeled as "prior art," illustrates a handguard **201** with key lock mounting points **202** and a mounting rail **106**. Two types of firearm accessories can be attached to the handguard of FIG. 2. One type is accessories for Picatinny rails that are clamped to the rail **106** and that often interface with the recoil grooves in the mounting rail **106**. The second type of accessory is those that attach to the key lock mounting points **202**. The keylock mounting points in FIG. 2 are "keyhole shaped" in that they have a larger round hole with a rounded slot extending outward. Other handguards have keylock mounting points that are not keyhole shaped but instead are slots that typically have rounded ends or rounded corners.

FIG. 3, labeled as "prior art," illustrates three keylock mounting points **302** as viewed from the underside which would also be the inside of a keylock mounting system **301**. The illustrated keylock mounting points are keyhole shaped with a larger round section **303** and a longer slotted section **304** extending out from the round section **303**. The illustrated slotted section **304** has an angled inner surface **305**. Other keylock mounting points do not have an angled inner surface **305**, round section **303**, or either.

FIG. 4, labeled as "prior art," illustrates a cut view of the keylock mounting point of FIG. 2-3. FIG. 4 provides a more detailed view of the angled inner surface **305** of a slotted section **304**.

A number of the firearm accessories are electrically powered. Many solutions simply include battery compartments. For example, a flashlight accessory is basically a battery powered flashlight with rail compatible mount points. More recently, solutions are being developed for electrifying the firearms and rail systems. Hines (U.S. Pat. No. 7,627,975) and Thompson (U.S. Patent Application 2011/0000120) teach bringing electrical power to forward mounted accessories. Darian (U.S. Patent Applications 2010/0192446, 2010/0192448, and 2011/0131858) also teaches powering firearm accessories from a firearm rail. Such rails can be referred to as empowered mounting rails.

Keylock mounting points are advantageous because they are lighter than mounting rails but they experience difficulties because it can be more difficult to mount accessories to keylock mounting points than to mounting rails. Certain current art electrified rail systems use powered firearm mounting rails that conduct electrical energy from an electrical input connection to one or more rail mounted devices. Systems and methods providing alternative methods of controlling and attaching electronic and electrified devices are needed.

BRIEF SUMMARY

The following summary is provided to facilitate an understanding of some of the innovative features unique to the embodiments and is not intended to be a full description. A full appreciation of the various aspects of the embodiments can be gained by taking the entire specification, claims, drawings, and abstract as a whole.

Systems and methods for powering electrical and electronic firearm accessories through covers for key lock mounting systems are needed.

It is therefore an aspect of the embodiments to provide a resilient cover that can be fastened to the mounting system and over the keyhole shaped openings. The cover has a main body and covers at least one, typically more, key lock mounting points. The cover uses keyhole grips to attach to the key lock mounting points. The keyhole grips extend from the bottom of the cover's main body and are shaped to fit into the keyhole shaped openings. The keyhole grips widen at the bottom such that they must be forcibly pushed into the keyhole opening. The resilience and shape of the cover material allows the keyhole grip to temporarily deform enough that the keyhole grip can be pushed into the keyhole opening. The keyhole grip is seated when the bottom of the cover's main body lies against the top surface of the mounting system, such as that illustrated in FIGS. 1 and 2. Note that the shape of the keyhole grip causes the resilient material to be deformed less, or be not deformed at all, when the cover is seated.

While useful, a single-grip cover may be prone to rotation. As such, some covers can have two or more keyhole grips spaced to attach to two or more key lock mounting points. Consecutive keyhole grips can fit into consecutive key lock mounting points or can be spaced further apart. Areas of the cover overlaying a key lock mounting point and lacking a keyhole grip can have openings to allow heat or rubble to escape through the mounting point.

The cover can be made of a material that is resilient enough that the keyhole grip temporarily deforms during insertion into the key lock mounting point. Once fully inserted, the keyhole grip returns to its original shape or as close to that shape as possible given the dimensions of the keyhole mounting point. The material is also resilient enough that the cover can be repeatedly attached and

removed from the key lock mounting system by pulling the cover away from the mounting system and without requiring access to or manipulation of the keyhole grip. The cover material should also be soft enough and resilient enough that the mounting system is not scratched, marred, or permanently deformed when the keyhole grips is pressed through the keyhole opening or when the cover is pulled off the mounting system. For example, a rubber cover can be used on an aluminum or hard plastic mounting system while an aluminum or steel cover is not resilient enough.

The cover has a cover body with the cover body having a cover top, cover bottom, a first end, a second end, and two sides. The covers can carry electrical current between the first end and the second end by incorporating a first circuit. The first circuit has a first connector fixedly located at the first end and a second connector fixedly located at the second end. A conductor inside the cover electrically connects the first connector and the second connector. The covers are designed to be mounted end to end on a mounting system such that the first circuit of one cover is electrically connected to similar circuits in adjacent covers. The first circuit can use a conductive cover body as the conductor between the connectors.

It is another aspect of the embodiments that the covers can have additional circuits substantially similar to the first circuit although only one of the circuits can use the cover body as a conductor. Some embodiments incorporate a circuit board within the covers and can have the connectors mounting on the circuit board.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying figures, in which like reference numerals refer to identical or functionally similar elements throughout the separate views and which are incorporated in and form a part of the specification, further illustrate the present invention and, together with the background of the invention, brief summary of the invention, and detailed description of the invention, serve to explain the principles of the present invention.

FIG. 1, labeled as "prior art," illustrates an M16 type firearm 101 with mounting rails 106;

FIG. 2, labeled as "prior art," illustrates a handguard 201 with key lock mounting points 202 and a mounting rail 106;

FIG. 3, labeled as "prior art," illustrates three keylock mounting points as viewed from the underside which would also be the inside of the keylock mounting system;

FIG. 4, labeled as "prior art," illustrates a cut view of the keylock mounting point of FIGS. 2-3;

FIG. 5 illustrates a cover having key shaped keyhole grips in accordance with aspects of the embodiments;

FIG. 6 illustrates a different view of the cover of FIG. 5 in accordance with aspects of the embodiments;

FIG. 7 illustrates a side view of the cover of FIGS. 5-6 in accordance with aspects of the embodiments;

FIG. 8 illustrates a cover having a step-patterned top surface and stepped keyhole shaped keyhole grips in accordance with aspects of the embodiments;

FIG. 9 illustrates a different view of the cover of FIG. 8 in accordance with aspects of the embodiments;

FIG. 10 illustrates a cover with a keyhole grip having two wedges and a v-notch in accordance with aspects of the embodiments;

FIG. 11 illustrates a view from the underside of the cover of FIG. 10 in accordance with aspects of the embodiments;

FIG. 12 illustrates a side view of the cover of FIGS. 10-11 in accordance with aspects of the embodiments;

5

FIG. 13 illustrates a view from above of the cover of FIGS. 10-12 in accordance with aspects of the embodiments;

FIG. 14 illustrates a view from above of the cover of FIGS. 10-13 attached to a keyhole mounting point such as that of FIG. 3 in accordance with aspects of the embodiments;

FIG. 15 illustrates a view from above of a cover attached to a slot shaped keyhole mounting point in accordance with aspects of the embodiments;

FIG. 16 illustrates two covers connected by free pins in accordance with aspects of the embodiments;

FIG. 17 illustrates a front view of a cover having substrate, overmold, and circuit board in accordance with aspects of the embodiments;

FIG. 18 illustrates a cut view of the cover of FIG. 17 and shows the substrate, overmold, and circuit board in accordance with aspects of the embodiments;

FIG. 19 illustrates a front view of the substrate of the cover of FIGS. 17-18 in accordance with aspects of the embodiments;

FIG. 20 illustrates a view from above of the substrate of FIG. 19 in accordance with aspects of the embodiments;

FIG. 21 illustrates a side view of the substrate of FIGS. 19-20 in accordance with aspects of the embodiments;

FIG. 22 illustrates a front view of the overmold of the cover of FIGS. 17-18 in accordance with aspects of the embodiments;

FIG. 23 illustrates a view from below of the overmold of the cover of FIG. 22 in accordance with aspects of the embodiments;

FIG. 24 illustrates a top view of a circuit board in accordance with aspect of the embodiments;

FIG. 25 illustrates a view from below of an overmold for a cover, the overmold having a thinned area for a button and slots for a top connector in accordance with aspects of the embodiments;

FIG. 26 illustrates a circuit board having pad, pin, and socket connectors in accordance with aspects of the embodiments;

FIG. 27 illustrates a firearm with a covers mounted on the firearms fore end, the covers passing electricity to each other and to various firearm accessories in accordance with aspects of the embodiments; and

FIG. 28 illustrates an input power connector in accordance with aspects of the embodiments.

DETAILED DESCRIPTION

The particular values and configurations discussed in these non-limiting examples can be varied and are cited merely to illustrate at least one embodiment and are not intended to limit the scope thereof. In general, the figures are not to scale.

Covers for key lock mounting systems on small arms such as the AR or M4 family of rifles and carbines can provide protection for the firearm and comfort for the operator. The cover has keyhole grips that are pressed into the key lock mounting points in mounting system. The cover is held seated against the surface of the mounting system by the shape and resilience of keyhole grips. V-notch keyhole grips can attach to keyhole shaped mounting points and slot shaped mounting points.

U.S. Ser. No. 14/593,134 was filed Jan. 9, 2015, is entitled "Cone Grip For Handgun" and is herein incorporated by reference in its entirety. U.S. Ser. No. 14/593,134 discloses a handgrip having an overmold and a substrate. It is for its

6

teachings of grips, overmolds, and substrates that U.S. Ser. No. 14/593,134 is herein included by reference in its entirety.

Provisional Application 62/056,172 was filed Sep. 26, 2014, is entitled "Cover For Key Lock Systems" and is herein incorporated by reference in its entirety. Provisional Application 62/056,172 discloses prior art keylock systems for mounting accessories to firearms and discloses a variety of embodiments of covers for key lock systems, many of which are also taught in this application. It is for its teachings of keylock systems and covers for keylock systems that Provisional Application 62/056,172 is herein included by reference in its entirety.

Provisional Application 62/232,393 was filed Sep. 24, 2015, is entitled "Cover For Key Lock Systems" and is herein incorporated by reference in its entirety. Provisional Application 62/232,393 discloses prior art keylock systems for mounting accessories to firearms and discloses a variety of embodiments of covers for key lock systems, many of which are also taught in this application. It is for its teachings of keylock systems and covers for keylock systems that Provisional Application 62/232,393 is herein included by reference in its entirety.

FIG. 5 illustrates a cover 501 having key shaped keyhole grips 502 in accordance with aspects of the embodiment. The cover body 505 has raised surface 503 over the keyhole grips and a non-raised surface 504 elsewhere such as between the keyhole grips. The cover 501 has two ends, a first end 506 and a second end 507. The first end 506 has a first connector 508 and a third connector 510. The second end 507 has a second connector 509 and a fourth connector 511. The first connector 508 is electrically connected to the second connector 509 by a conductor such as a wire passing through the cover body 505. The third connector 510 is electrically connected to the fourth connector 511 by a second conductor such as a wire passing through the cover body 505. The first connector 508, second connector 509, and conductor are all parts of a first circuit. The third connector 510, fourth connector 511, and second conductor are all parts of a second circuit. When cover 501 is by itself, as shown in FIG. 5, the first circuit and the second circuit are electrically isolated from one another. For example, the cover body 505 can be formed from an electrical insulator such that electricity cannot flow from the first circuit to the second circuit. Alternatively, an insulated wire having a conductor surrounded by an insulating jacket can electrically connect two of the connectors while the other two connectors are electrically connected by a conductive cover body. The conductor, second conductor or both can be formed from a conductive rubber, plastic, silicone, or other formulation. In another embodiment, the cover body 505 is a conductive rubber, plastic, silicone, or other formation and the first circuit and second circuit are electrically insulated from each other and from the cover body such that the cover body provides electrical shielding to the first circuit and the second circuit.

The connectors of FIG. 5 are pins 509, 511 and sockets 508, 510. A series of covers, all substantially similar to cover 501, can be aligned end to end and plugged into one another to thereby cover a longer area and to also to elongate the first circuit and the second circuit.

FIG. 6 illustrates a different view of the cover 501 of FIG. 5 in accordance with aspects of the embodiments. The keyhole grips 502 can be seen to be keyhole shaped and to have a narrow part 602 and a wide part that has a rounded lower portion 601. The first circuit and the second circuit are

7

substantially inside the cover body **505** with the connectors **508**, **509**, **520**, **511** accessible at the ends **506**, **507** of the cover **501**.

FIG. 7 illustrates a side view of the cover **501** of FIGS. 5-6 in accordance with aspects of the embodiments. The raised surface **503** can be seen as can the narrow part **602** and the wide part **601** of the keyhole grip **502**. Also more clearly visible is the widest part **701** of the wide part **601**. Pressing the keyhole grip **502** into a key lock mounting point **302** causes the keyhole grip to deform until the widest part **701** has been pressed through the opening. Being made of resilient material, the keyhole grip attempts to return to its original shape and the widest part **701** presses out. When pressed into a mounting point such as that of FIGS. 3-4, the widest part presses out and into the angled inner surface. It is this action of the keyhole grip pressing out and into the side of the keyhole mounting point that holds the cover **501** and all similar covers onto keylock mounting systems. In some embodiments, the firearm grip or fore end can be electrically conductive such that an electrically conductive cover body becomes electrically connected to the fore end when pressed into position on the fore end. Such electrical connectivity can be advantageous for shielding electronics and circuitry or for providing a common electrical ground.

FIG. 8 illustrates a cover **801** having a step-patterned top surface **804** and keyhole grips **802** with stepped wide parts **803** in accordance with aspects of the embodiments. The stepped wide part allows the keyhole grip to better match the stepped contour on the underside of keyhole mounting points such as those of FIGS. 3-4 in which part of the underside has an angled surface and another part does not. This particular cover **801** has two additional socket type connectors **805**, **806** through which a firearm accessory can connect to the first circuit and second circuit to thereby be electrically powered by way of cover **801**. As illustrated, fifth connector **805** is part of the first circuit while sixth connector **806** is part of the second circuit.

FIG. 9 illustrates a different view of the cover **801** of FIG. 8 in accordance with aspects of the embodiments. As with other keyhole grips, the keyhole grip of FIG. 9 has a narrow part **901**. The stepped wide part has a first rounded lower portion **802** and a second rounded lower portion **803**.

FIGS. 10-14 illustrate a cover **1001** with a keyhole grip **1102** having two wedges **1004** and a v-notch **1005** in accordance with aspects of the embodiments. The cover has a cover body **1002** with a cover top **1202** and a cover bottom **1101**. The keyhole grip **1102** has a narrow part **1103** and a wide part **1301** with the wedges **1004** being part of the wide part. The wedges **1104** have an upper surface **1006**. FIG. 12 illustrates an aggressively patterned cover top **1202** whereas other cover tops can be smooth, lightly textured, or otherwise patterned. FIGS. 14-15 show the cover **1001** fixed to a keyhole system **301**. The illustrated keyhole system has keyhole shaped keyhole mounting points although cover **1001** can as easily be fixed to slot shaped keyhole mounting points. FIG. 12 shows that this particular embodiment has round ends **1202** that can have a radius equal to that of the rounded slot ends **1401**.

FIG. 10 illustrates a front view of the cover of FIGS. 10-14. FIG. 11 illustrates a view from the underside of the cover of FIGS. 10-14. FIG. 12 illustrates a side view of the cover of FIGS. 10-14. FIG. 13 illustrates a view from above of the cover of FIGS. 10-14. FIG. 14 illustrates a view from above of the cover of FIGS. 10-14 attached to a keyhole mounting point such as that of FIG. 3.

FIG. 15 illustrates a view from above of a cover **1501** attached to a slot shaped keyhole mounting point **1502**. The

8

illustrated keyhole mounting system **1503** has slot shaped key hole mounting points **1502** instead of the keyhole shaped ones of FIG. 14.

FIG. 16 illustrates two covers **1601**, **1602** connected by free pins **1605** in accordance with aspects of the embodiments. Free pins **1605** are pins that can be pulled completely from and re-inserted into compatible sockets such as sockets **1603**. Free pins are different from captured pins **509**, **511** which are fixed in place and cannot be pulled free without damaging or destroying a connector. Covers **1601** and **1602** can be pressed together end-to-end such that the free pins **1605** are pressed into sockets **1603** such that the cover's **1601**, **1602** first circuits are electrically connected and such that the cover's **1601**, **1602** second circuits are electrically connected. Cover **1601** and **1602** differ internally but are compatible with one another and can be plugged together as indicated in FIG. 16.

Cover **1602** of FIG. 16 has conductors **1604** that electrically connect the sockets **1603** on opposing ends of the cover **1602**. As such, conductors **1604** can be bare wires or conductive channels passing through a non-conductive cover body **1606**. The non-conductive cover body **1606** insulates the first circuit (top) from the second circuit (bottom).

Cover **1601** of FIG. 16 has an insulated wire **1607** or insulated conductor connecting insulated sockets **1609**. The cover body **1608** of cover **1601** is formed from a conductive material. The first circuit of cover **1601**, having insulated sockets **1609** and conductor **1607**, is not electrically connected to cover body **1608**. Sockets **1603** are not insulated and are electrically connected to cover body **1608**. Therefore, the second circuit of cover **1601** includes the two sockets **1603** and the cover body **1608** that electrically connects the two sockets **1603**. Note that a cover similar to cover **1602** can be constructed with a conductive body, insulated conductor, and insulated sockets such as those of cover **1601** to thereby produce a cover with conductive body and insulated first and second circuits.

FIGS. 17-18 illustrate a front view of a cover **1701** having a substrate **1703**, overmold **1702**, and circuit board **1707** in accordance with aspects of the embodiments. The substrate **1703** includes the keyhole grip **1704** and a lower portion **1705** of the cover body **1706**. The substrate **1703** is a plastic that provides structural rigidity to the cover while the overmold **1702** is a softer plastic that provides an ergonomic gripping surface and form. The substrate material is not only more rigid than the overmold material but also gives the keyhole grip **1704** a less resilient surface than the overmold material. The less resilient surface is less prone to binding in a key hole mounting point before the keyhole grip is fully inserted. The substrate material typically has a higher melting point than the overmold material such that substrates can be formed first and then overmolds cast directly over and into the substrates. The circuit board should also be able to withstand melted overmold material. An alternative is to attach the connectors and conductors of the first circuit and second circuit directly to the substrate or to cast the substrate around the first and second circuit. Yet another alternative is to form the substrate and overmold separately, assemble the cover with the circuit board properly positioned, and to apply heat or adhesives to bind the components together.

FIG. 17 illustrates a front view of a cover **1701** having substrate **1703**, overmold **1703**, and circuit board **1707**. FIG. 18 illustrates a cut view of the cover **1701** and shows substrate **1703**, overmold **1703**, and circuit board **1707** in accordance with aspects of the embodiments.

FIGS. 19-21 illustrate aspects of substrate 1703 of FIGS. 17-18. The substrate can be a single molded piece with the lower cover body 1705 and keyhole grip 1704 which has wedges 1901 and v-notch 1902. It should be noted that the keyhole grip of cover 1701 can be very similar, even identical, in form, to the keyhole grips of other embodiments contemplated herein. Although the substrate material is more rigid than the overmold material, the substrate material must be resilient enough that the keyhole grip can be pressed into a key hole mounting point without breaking and must be resilient enough that the wedges press outward and hold the cover 1701 to the mounting system.

FIG. 19 illustrates a front view of substrate 1703. FIG. 20 illustrates a view from above of substrate 1703. FIG. 21 illustrates a side view of substrate 1703.

FIGS. 22-23 illustrate a views and aspects of overmold 1702 of cover 1701 of FIGS. 17-18 in accordance with aspects of the embodiments. Overmold 1702 includes the top portion of the cover body 2201 and a cavity 2202 into which the circuit board 1707 and top portion 1705 of the substrate 1703 fits. Holes in the ends of the cover body 2201 provide access to the cover's connectors or for connectors to pass through the ends of the cover body to thereby be accessible.

FIG. 22 illustrates a front view of overmold 1702. FIG. 23 illustrates a view from below of overmold 1702.

An embodiment similar to that of FIGS. 17-23 reverses the overmold and the substrate elements such that the elements illustrated in FIGS. 19-21 become the overmold and are made of the softer more resilient overmold material and such that the elements illustrated in FIGS. 22-23 become the substrate and are made of the harder and less resilient substrate material.

FIG. 24 illustrates a top view of a circuit board 2401 in accordance with aspect of the embodiments. The circuit board 2401 has a substrate 2402 a first circuit and a second circuit. The first circuit has a first connector 2403, second connector 2404, conductor 2405, and switch 2409. Conductor 2405 electrically connects first connector 2403 and second connector 2404. Switch 2409 can interrupt the electrical connection between first connector 2403 and second connector 2404. Another way of describing the first circuit would split conductor 2405 into two conductors with each conductor connecting a connector to the switch such that operating the switch makes and breaks the electrical connection between the connectors. The second circuit has a third connector 2406, fourth connector 2407, conductor 2408 electrically connecting third connector 2406 and fourth connector 2407.

Switch 2409 can be accessible through a hole in cover body or can be operated by pushing onto a spot on the cover body. For example, the cover body can have a thinned area over the switch in order to ease operation of the switch. In such embodiments, successive presses of the switch can make and break the first circuit. Such operation can be achieved mechanically or electronically wherein the switch contains mechanical elements or electronic logic. Such switches are known in the art and can even be purchased as assemblies for mounting on circuit boards.

The circuit board of FIG. 24 is illustrated with the first and third connectors 2403, 2406 sticking past the edge of the circuit board. This provides for the first and third connectors 2403, 2406 to be flush with the ends of the cover body because the circuit board is inside the cover body. Note that the first and third connectors 2403, 2406 are socket connectors, and that the second and fourth connectors 2404, 2407

are pin connectors. Other embodiments can require the pins of adjacent covers to pass into the cover body before reaching the sockets.

FIG. 25 illustrates a view from below of an overmold 2501 for a cover, the overmold 2501 having a thinned area 2502 for a button and slots 2503 for a connectors in accordance with aspects of the embodiments.

FIG. 26 illustrates a circuit board 2601 having pad 2603, 2606, pin 2604, 2607, and socket connectors 2602, 2609 in accordance with aspects of the embodiments. The pin connectors 2604, 2607 can be spring loaded or magnetic. A spring loaded pin connector has a spring or other element pushing the pin outward from the pin connector housing. When the pin is pushed against a pad connector then the pin can retreat into the pin connector housing such that the pin presses against the pad connector and an electrical contact is maintained between pin and pad. A magnetic pin connector has the pin retracted at least partially into the pin connector housing until a pad connector is brought close. Magnetic attraction causes the pin to extend from the pin connector housing and maintain electrical contact with the pad connector.

The first circuit has first connector 2603, second connector 2604, conductor 2605, and fifth connector 2609. The second circuit has third connector 2606, fourth connector 2607, and sixth connector 2602. The first connector 2603 and third connector 2606 are pad connectors. Second connector 2604 and fourth connector 2607 are pin connectors. Fifth connector 2609 and sixth connector 2602 are socket connectors. Holes in the cover body such as slots 2503 can provide access to the socket connectors which may be wholly within the cover body, flush with the cover body, or extend out of the cover body. Firearm accessories can be attached to a firearm by pressing the accessory into the socket connectors. Other embodiments simply combine the firearm accessory with the cover such that the accessory can be powered or controlled by an adjacent cover.

FIG. 27 illustrates a firearm 2706 with a covers 2709 mounted on the firearm fore end 2707, the covers 2709 passing electricity to each other and to various firearm accessories in accordance with aspects of the embodiments. An operator 2701 can carry the firearm 2706 and wear a vest 2702 or back pack 2704. The vest 2702 can have an integral or attached power supply 2703. Similarly, the back pack 2704 can be fitted with a power supply 2705. The power supplies can supply electrical power to the covers 2709 by way of input connectors 2708 that receive electrical energy and interface electrically with the covers. The covers 2709 are illustrated as lined up on either side of the firearm fore end 2707. As such, the covers 2709 on the left side of the fore end are all electrically connected and receiving power from a power supply 2703, 2705. Similarly, the covers 2709 on the right are all electrically connected and receiving power from a power supply 2703, 2705.

A variety of firearm accessories are connected to the covers 2709 and receiving electrical power from the covers 2709. Note that the accessories can alternatively be integral with the covers. The accessories are a camera 2710, a battery monitor 2711 that can observe the charge state of the power supplies, a GPS receiver 2712, and infra-red light 2713, a colored light 2714, a white light 2715, a non-transitory memory 2716 that can store data received by or produced by another accessory, an LCD display 2717 that can display information provided by another firearm accessory, a laser designator 2718, a video camera 2719, a data transceiver 2720, a data downlink 2721, a data uplink 2722, and an output power connector 2723. The output power connector

11

2723 is shown powering a flashlight 2724 that is not necessarily mounted on the firearm fore end, for example, the flashlight 2724 can be taped to the firearm barrel or even carried by another operator.

FIG. 28 illustrates an input power connector 2801 in accordance with aspects of the embodiments. The illustrated input power connector 2801 can be, essentially, a cover 2801 with wires 2803, 2804 exiting one edge instead of having sockets. The wires are connected internally to the first and second circuits. The opposite edge of the input power connector 2801 can have pins 509, 511 or pads or sockets. Alternatively, an input power connector can simply be a plug similar to the input power connector 2801 of FIG. 28 but lacking the key locking elements. Another alternative embodiment of the input power connector is a plug that plugs into the top sockets of a cover such as sockets 2609, 2502. Yet another embodiment would have wires passing directly through the cover top, side, or bottom and permanently connected to the first and second circuits. Embodiments using a conductive cover body as the conductor in one of the circuits can have a single wire plugged into or permanently fixed to the other circuit. A further embodiment is simply wires plugged into the sockets of a cover such as the cover 501 of FIG. 5.

The output power connector can be substantially similar to the input power connector. An interesting use of the power connectors is that one firearm can be electrically connected to another firearm such that one powers the electrical accessories of the other.

It will be appreciated that variations of the above-disclosed and other features and functions, or alternatives thereof, may be desirably combined into many other different systems or applications. Also, that various presently unforeseen or unanticipated alternatives, modifications, variations or improvements therein may be subsequently made by those skilled in the art which are also intended to be encompassed by the following claims.

What is claimed is:

1. A cover for a firearm fore end comprising a plurality of key lock mounting points, the cover comprising:

an overmold comprising a first resilient material;
a substrate comprising a second resilient material that is not the first resilient material;

a cover body comprising a cover top, a cover bottom, a first end, and a second end;

a keyhole grip comprising a narrow part and a wide part, wherein the keyhole grip is fixed to the cover bottom, wherein the keyhole grip is dimensioned to be pressed into at least one point of the plurality of the key lock mounting points, wherein the keyhole grip comprises the first resilient material or the second resilient material, wherein pressing the keyhole grip into the key lock mounting point causes the wide part to deform more than the narrow part, wherein the narrow part is between the wide part and the bottom of the cover body, wherein the wide part comprises two wedges, wherein pressing the keyhole grip into the key lock mounting point causes the wedges to press together until a widest part of the wide part has passed through the key lock mounting point, wherein the wedges press back apart as the widest part is pressed past the key lock mounting point, and wherein the two wedges are separated by a v-notch; and

a first circuit comprising a first connector, a second connector, and a conductor wherein the conductor electrically connects the first connector to the second connector, wherein the first connector is fixedly located

12

at the first end, and wherein the second connector is fixedly located at the second end.

2. The cover of claim 1 further comprising a circuit board wherein the circuit board comprises the conductor, wherein the first connector is fixedly attached to the circuit board, and wherein the second connector is fixedly attached to the circuit board.

3. The cover on claim 2 wherein the first circuit further comprises a switch that controls the flow of electricity between the first connector and the second connector, and wherein the switch is fixedly attached to the circuit board.

4. The cover of claim 2 wherein the first circuit further comprises a switch and a third connector, wherein the switch controls the flow of electricity between the first connector and the third connector, wherein the switch is fixedly attached to the circuit board, and wherein the third connector is accessible through the cover top such that a firearm accessory can be positioned on the cover top and electrically connected to the first circuit.

5. The cover of claim 1 wherein the conductor has a length and wherein the first resilient material fully encapsulates the conductor along the length.

6. The cover of claim 1 wherein the conductor has a length and wherein the second resilient material fully encapsulates the conductor along the length.

7. The cover of claim 1 further comprising a second circuit comprising a third connector, a fourth connector, and a second conductor, wherein the second conductor electrically connects the third connector to the fourth connector, wherein the third connector is fixedly located at the first end, wherein the fourth connector is fixedly located at the second end, and wherein the overmold electrically insulates the second circuit from the first circuit.

8. The cover of claim 1 further comprising a second circuit comprising a third connector, a fourth connector, and a second conductor, wherein the second conductor electrically connects the third connector to the fourth connector, wherein the third connector is fixedly located at the first end, wherein the fourth connector is fixedly located at the second end, and wherein the substrate electrically insulates the second circuit from the first circuit.

9. The cover of claim 1 further comprising a second cover that is identical in form to the cover wherein the second end of the cover is plugged into the first end of the second cover such that the first circuit of the cover is electrically connected to the first circuit of the second cover.

10. The cover on claim 1 wherein the first circuit further comprises a switching device that controls the flow of electricity between the first connector and the second connector.

11. The cover of claim 1 wherein the first circuit comprises a magnetic contact.

12. The cover of claim 1 wherein the first circuit comprises a plug.

13. The cover of claim 1 wherein the first circuit comprises a socket.

14. The cover of claim 1 further comprising a second circuit comprising a third connector, a fourth connector, and a second conductor, wherein the second conductor electrically connects the third connector to the fourth connector, wherein the third connector is fixedly located at the first end, wherein the fourth connector is fixedly located at the second end, and wherein the cover electrically insulates the second circuit from the first circuit.

15. The cover of claim 14 wherein the first circuit further comprises a top connector, wherein the second circuit fur-

ther comprises a second top connector, and wherein the top connector and second top connector are accessible through the cover top.

16. The cover of claim 7 wherein the first circuit further comprises a top connector, wherein the second circuit further comprises a second top connector, and wherein the top connector and second top connector are accessible through the cover top. 5

17. The cover of claim 8 wherein the first circuit further comprises a top connector, wherein the second circuit further comprises a second top connector, and wherein the top connector and second top connector are accessible through the cover top. 10

18. The cover of claim 1 wherein the first circuit further comprises a top connector, and wherein the top connector is accessible through the cover top. 15

* * * * *